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ChatGPT and beyond with AI in health: lessons to be learned
Rodolphe Thiébaud^{1,2,3}, Boris Hejblum^{1,2}, Fleur Mougin¹, Christophe Tzourio^{1,3}, Laura Richert^{1,2,3}

1. Univ. Bordeaux, INSERM, Bordeaux Population Health, U1219, F-33000 Bordeaux, France
2. INRIA, SISTM, F-33000 Bordeaux, France
3. CHU Bordeaux, Medical Information Department, F-33000 Bordeaux, France

Corresponding author :

Pr Rodolphe Thiébaud
INSERM, Bordeaux Population Health
Université de Bordeaux
146 Rue Leo Saignat 33076 Bordeaux Cedex
France
Email : rodolphe.thiebaut@u-bordeaux.fr

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ChatGPT (OpenAI; San Francisco, CA) has put artificial intelligence (AI) again in the spotlight of the media's scene. Rather than a new technological revolution, ChatGPT is a new impulse helping us to think and accompany the digital transformation of our society. Here, we would like to present some lessons we might learn from and for the development of AI to improve population health. This is an opinion paper that does not aim to be exhaustive. Many other papers have been published as well as opinions posted that are nicely nourishing the debate [1–3].

Lesson 1: be data-rich

GPT (Generative Pretrained Transformer) is a large language model, a type of AI algorithm designed to process and understand natural language [4]. It is based on neural networks that are trained on vast amounts of text data to learn patterns and relationships between words and phrases. If they are trained on a large enough dataset, these models are capable of generating new sequences of words not seen in the learning dataset but that represent plausible sequences of words in natural human language. In addition to the data used for initial training, some model such as InstructGPT[4], include reinforcement learning algorithms, allowing the model to improve based on the user responses. Of note, ChatGPT does not access external sources of information once trained, and thus there are no direct queries directed towards the internet.

Therefore, the power of such an algorithm comes first and foremost from the information used to train it. Of note, the algorithms are still far less efficient than humans at learning and need much more data to learn a given task. Learning from data available on the web is very powerful but for applications in healthcare there is a need for specific data, coming from electronic health records, medical images and so on. This is why any progress of the implementation of AI in healthcare relies on the work done to organize the data and make them available.

Lesson 2: be easy to use

Over time, there is a clear improvement of AI algorithms. They tend towards more autonomy, reinforcement learning being a good example, and more generalizability. Generalizability is paramount to obtain a practical tool in medicine [5]. For instance, having an efficient algorithm to detect nodules on a chest X ray is great, but what is truly needed is an algorithm capable of analyzing the whole image and identifying any type of lesion.

Interestingly, large language models implemented in chatbots are very demonstrative for the concept of AI, but they are also illustrating the idea of dynamic task specifications where results can be improved by refining more precise prompts following each answer. This is the art of prompting, i.e the skill to ask the right questions to chatGPT to get the answer you seek, a new job emerging.

However, the first reason that has made chatGPT popular is probably not the technical improvement of the tool but its accessibility. Everybody can access chatGPT through a webpage and its use has quickly skyrocketed. Interestingly, the increase of users and questions also makes the algorithm more efficient (see above about reinforcement learning).

This is a very important lesson when thinking about implementation in healthcare. One of the main expected gains from AI for healthcare workers is saving time[6]. Therefore, it is imperative that any tool is easy to access and to use.

Lesson 3: be useful

Being used does not necessarily mean being useful. There is a long journey separating the construction of an algorithm from its actual implementation in daily care. A major step is the evaluation of the clinical benefit brought by the application. Although, some AI systems have already been approved, their evaluation is challenging and still an area of research by itself as the algorithms evolve rapidly. In a review of AI-devices approved from 2015 to the end of 2020, almost all devices (126/130) had only undergone retrospective evaluation at the time of their regulatory submission [7].

AI systems applications in health are plentiful. They started from image analysis thanks to the availability of deep learning algorithms and moved on to the epidemiological surveillance of emerging infectious diseases. Large language models could help with communication, as proposed by chatbots for a frontline healthworker in the context of mental health disorders. They are also capable of generating treatment recommendations, drug interactions... but at high risk for patients themselves that these are language predictions instead of medical facts.

One example of an FDA-approved AI product is IDx-DR (Digital Diagnostics, Coralville, IA, USA), which is a software system that uses AI to diagnose diabetic retinopathy. The system analyzes retinal images and can detect the presence of diabetic retinopathy. FDA approval came after a pivotal trial performed in 10 primary care sites [8]. Another example is the Viz.ai stroke detection software (San Francisco, CA, USA), which uses AI to analyze CT scans and identify patients who may be suffering from a stroke. These are just a few examples of how AI is already transforming medical practice [9].

Lesson 4: be under control

The development of AI systems and their implementation are risky. They require control measures to ensure the safe and effective use of AI in healthcare. As AI algorithms like the ones used in ChatGPT can be very complex, it is important to understand how they work, the source of information they use and to explain their decisions. Hence, explainable AI is a whole area of research. It should however be noted that the full explainability is not needed to be evidenced-based[10]. Making sure that the final result of the algorithm is valid and reproducible relates to trustworthy AI. It is essential to define an ethical and legal framework for AI in healthcare. This framework should address issues such as privacy [11], bias[12], and accountability. The ethical implications of AI in healthcare are still extensively debated in the literature[13], and a variety of guidelines and principles have been proposed to guide its development and deployment (see for instance [14]). These guidelines aim to ensure that AI is used in ways that are transparent, fair, and respectful of human values and dignity.

Lesson 5: be taught

ChatGPT has nearly the accuracy performance (60%) to pass the United States Medical Licensing Exam (USMLE) that is required for medical licensure in the United States[15]. Teachers are afraid that students are using ChatGPT to perform their homework.

These facts are an additional argument to adapt if not revolutionize the training of future healthcare workers. Two main aspects should be considered: i) healthcare professionals should know how to use AI-tools and ii) the program could be change by lighting technical knowledge and increasing human sciences content.

Education and training are fundamental aspects to optimize and control the usefulness of AI. As AI is rapidly transforming healthcare, it is important for healthcare workers to be trained how to use AI tools effectively [16].

Although fundamentals of each discipline should still be taught in initial training, the pace of the renewal of medical knowledges requires skills in how to find updated information or how to question AI-systems (e.g. through prompting). Moreover, in parallel of the progresses done by researchers in AI on human-machine interactions, training of future healthcare workers could be enriched by courses in human sciences, that is improving human-human interactions. The patients themselves are looking for a human supervision of AI-tools[17].

In addition to revising the content of curricula, AI also requires continuing the modification of the pedagogic approach. Simple exposure of the state-of-the-art should be replaced by a more dynamic student-centered learning approach, continuously evaluating the progress of the students. The adaptation of the teaching programs requires more teaching time from the professors, who should also learn and become literate in AI. This obviously has an impact beyond medical studies alone, and concerns many different disciplines such as informatics, law,... , if not all.

There is a need for a huge effort to revise and amplify training programs, which means updating the skills of professors with dual competencies in AI and health. Here also, AI could be useful in leveraging teaching activities with, for instance, curiosity-driven exploration [18].

Last words

Increasing and adapting training capacities of future healthcare workers is, to our opinion, an absolute priority to ensure that future healthcare workers will take the advantage of AI and control the risk of its use.

References

- [1] Lee P, Bubeck S, Petro J. Benefits, Limits, and Risks of GPT-4 as an AI Chatbot for Medicine. *N Engl J Med* 2023;388:1233–9. <https://doi.org/10.1056/NEJMSr2214184>.
- [2] Will ChatGPT transform healthcare? *Nat Med* 2023;29:505–6. <https://doi.org/10.1038/s41591-023-02289-5>.
- [3] Rajpurkar P, Chen E, Banerjee O, Topol EJ. AI in health and medicine. *Nat Med* 2022;28:31–8. <https://doi.org/10.1038/s41591-021-01614-0>.
- [4] OpenAI. Introducing ChatGPT 2023. <https://openai.com/blog/chatgpt> (accessed April 16, 2023).
- [5] Moor M, Banerjee O, Abad ZSH, Krumholz HM, Leskovec J, Topol EJ, et al. Foundation models for generalist medical artificial intelligence. *Nature* 2023;616:259–65. <https://doi.org/10.1038/s41586-023-05881-4>.
- [6] Do HM, Spear LG, Nikpanah M, Mirmomen SM, Machado LB, Toscano AP, et al. Augmented Radiologist Workflow Improves Report Value and Saves Time: A Potential Model for Implementation of Artificial Intelligence. *Acad Radiol* 2020;27:96–105. <https://doi.org/10.1016/j.acra.2019.09.014>.
- [7] Wu E, Wu K, Daneshjou R, Ouyang D, Ho DE, Zou J. How medical AI devices are evaluated: limitations and recommendations from an analysis of FDA approvals. *Nat Med* 2021;27:582–4. <https://doi.org/10.1038/s41591-021-01312-x>.
- [8] Abràmoff MD, Lavin PT, Birch M, Shah N, Folk JC. Pivotal trial of an autonomous AI-based diagnostic system for detection of diabetic retinopathy in primary care offices. *NPJ Digit Med* 2018;1:39. <https://doi.org/10.1038/s41746-018-0040-6>.
- [9] Karamchandani RR, Helms AM, Satyanarayana S, Yang H, Clemente JD, Defilipp G, et al. Automated detection of intracranial large vessel occlusions using Viz.ai software: Experience in a large, integrated stroke network. *Brain Behav* 2023;13:e2808. <https://doi.org/10.1002/brb3.2808>.
- [10] McCoy LG, Brenna CTA, Chen SS, Vold K, Das S. Believing in black boxes: machine learning for healthcare does not need explainability to be evidence-based. *J Clin Epidemiol* 2022;142:252–7. <https://doi.org/10.1016/j.jclinepi.2021.11.001>.
- [11] Price WN, Cohen IG. Privacy in the age of medical big data. *Nat Med* 2019;25:37–43. <https://doi.org/10.1038/s41591-018-0272-7>.
- [12] Obermeyer Z, Powers B, Vogeli C, Mullainathan S. Dissecting racial bias in an algorithm used to manage the health of populations. *Science* 2019;366:447–53. <https://doi.org/10.1126/science.aax2342>.
- [13] Char DS, Shah NH, Magnus D. Implementing Machine Learning in Health Care - Addressing Ethical Challenges. *N Engl J Med* 2018;378:981–3. <https://doi.org/10.1056/NEJMp1714229>.
- [14] WHO. Ethics and governance of artificial intelligence for health 2021. <https://www.who.int/publications/i/item/9789240029200> (accessed April 15, 2023).
- [15] Kung TH, Cheatham M, Medenilla A, Sillos C, De Leon L, Elepaño C, et al. Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digit Heal* 2023;2:e0000198. <https://doi.org/10.1371/journal.pdig.0000198>.
- [16] McCoy LG, Nagaraj S, Morgado F, Harish V, Das S, Celi LA. What do medical students actually need to know about artificial intelligence? *NPJ Digit Med* 2020;3:86. <https://doi.org/10.1038/s41746-020-0294-7>.

- [17] Young AT, Amara D, Bhattacharya A, Wei ML. Patient and general public attitudes towards clinical artificial intelligence: a mixed methods systematic review. *Lancet Digit Heal* 2021;3:e599–611. [https://doi.org/10.1016/S2589-7500\(21\)00132-1](https://doi.org/10.1016/S2589-7500(21)00132-1).
- [18] Ten A, Kaushik P, Oudeyer P-Y, Gottlieb J. Humans monitor learning progress in curiosity-driven exploration. *Nat Commun* 2021;12:5972. <https://doi.org/10.1038/s41467-021-26196-w>.